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Memo For Record

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Ser. RAG-302

March 22, 1960

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From: [redacted]

Project: OX

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Subject: Visit to [redacted] Illinois

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On 14 March 1960 the writer accompanied [redacted] to the subject facility for the purpose of presenting proposed specifications for a V/H sensor, in order to determine the capability of [redacted] to produce a device with the desired characteristics. The following [redacted] personnel participated in part or all of the discussions:

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[redacted] Marketing Manager
Manager, Project Engineering
Chief of Research and Development
Manager of Recon. Systems
Director of Engineering
Director of Customer Relations

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[redacted], Eastern District Sales Representative, did not participate in the discussions, but was introduced briefly.

The proposed specification drawn up by Eastman Kodak Company was submitted for discussion and the characteristics of a V/H system currently under development were introduced by [redacted] 25X1A
The latter system is to be an application of what [redacted] calls its 25X1A
'SOLO' device, for Stabilized Optical Lock On, which is an optical seeker-tracker from which the necessary rate pick-offs can be 25X1A
obtained; it is this system which [redacted] intends to propose to [redacted] in response to a recent bid request. This bid request has been described by MFR-RAG-301, from information obtained at [redacted] 25X1A

With respect to the EKCo. proposed specification discussion centered principally upon the areas of operability under conditions of 75% cloud cover, rejection of lock-on to clouds, environmental conditions, and optical effect of vehicle shock wave. The stated requirement of 0.5% accuracy was stated to be attainable, with a probable accuracy as high as 0.1%. A more precise definition of accuracy seems to be required, as to whether the error should be a root-mean-square error, or whether maximum error is to be specified. 25X1A

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The device which [redacted] is proposing to [redacted] may be described as follows:

1. A stabilized tracking detector.

2. Computing circuitry which will have a frequency or voltage output, proportional to the ratio V/H.

The tracking head, or "SOLO device, will utilize a [redacted], and will lock-on a point of scene contrast in the vicinity of 10 degrees forward, track this point through an angle of 20 degrees, and reset. The pitch rate and azimuth rate are derived from the tracking head. The tracking cycle will take about seven seconds. 25X1D

The computing section will have a controllable oscillator whose frequency is counted down and related to the reciprocal of the rate determined by the detector, which appears as a binary number in a storage, and the oscillator then will be corrected in frequency as may be required. The variable frequency thus obtained can be detected and converted to a voltage signal proportional to the ratio of V/H; in the case of the [redacted] proposal the controllable oscillator frequency will be of the order of 1000 cps for a V/H ratio of 0.05 radians per second. The reciprocal of V/H, in binary form, is available as an output of ten parallel bits. 25X1A

25X1A After reviewing the requirements presented by the EKCo. proposal, [redacted] felt that the basic system as described above would suffice, with the following probable characteristics. The tracking angle could be reduced to a total angle of ten degrees, and a tracking cycle period of four seconds. The output would most likely consist of V/H in terms of frequency (at say five volts rms), angle in terms of a slowly varying "D-C" voltage, and the binary number representing H/V in ten bits, as above. In order to accommodate the requirement of operation under conditions of 75% cloud cover, it was felt that three sources of information might be tapped; namely, target, brightness, target spectral properties, and history of input with regard to these and rate in the previous acquisition, or scan.

25X1A The total power requirement specified is 100 watts; it was stated by [redacted] that this probably need not exceed 50 watts. No difficulty was foreseen with the types of power specified.

With respect to specification of the minimum light level for proper operation, it was stated that no automatic exposure determination device is planned for the instrumentation. It was agreed that a more precise definition of this requirement should be included in any later discussions.

All of the V/H hardware in current production of operation uses electron tubes. [redacted] stated that semiconductor work at [redacted] is in the laboratory R & D stage. In this connection it was noted that the temperature requirements of the proposed specification would require the use of Silicon semiconductors. No altitude problems are anticipated in the electronics.

Much discussion was centered upon the required stabilization of the V/H device. It was noted that the main equipment will be mounted on a stable platform which will not be pitched, although the instrument itself will be pitched at a rate determined by the V/H device. It was acknowledged that stabilization of the V/H detector, either entirely self-contained or using an external reference might be obviated if the non-pitching platform would be sufficiently stable. [redacted] expressed a preference for stabilizing the V/H device, however, and stated that it would then appear desirable to mount it on the same frame as the instrument. Rate stabilization rather than position stabilization would be preferable. A considerable saving in weight might be realized if stabilization could be omitted. The weight of the V/H equipment with stabilization might be as much as twice that without, and would probably be of the order of 28 pounds, which is higher than the 15 pounds arbitrarily called out in the proposed specification. Reactive torque due to stabilization would probably not exceed one ounce-inch.

It was stated that no driver controls other than equipment turn-on-off, and possibly selection of fully automatic and programmed IMC correction would be permitted.

In response to inquiry by [redacted] it was disclosed that some information is available regarding the shock wave of the vehicle, and the angle was stated to 18° approximately at the position of the equipment. The change of angle of refraction caused by sweeping the shock wave over the anticipated required angle was stated to be of the order of five minutes. It was stated that the atmosphere in the vicinity of the equipment may be helium at the pressure stated in the proposed specification.

Much discussion, initiated by [redacted] centered upon the effect of the shock wave upon the accuracy of the tracking device. [redacted] pointed out that this would likely be a predictable correction of second order magnitude, and adequate compensation could be built into the equipment.

Discussion of the effects of operating at low atmospheric pressure, combined with high temperatures was initiated by [redacted] with particular respect to bearings. It was agreed that dissimilar lubrication techniques might be required for normal

operation and for ground testing, or possibly that different criteria of satisfactory performance would be set up, between ground and full operational testing. The need for simulation was discussed for ground testing.

In a tour of plant facilities some of the present V/H detecting hardware was examined. None of the presently operational equipment is of the type discussed above, but the most recent design, which was also viewed at [redacted], has a self-contained stable platform for the detector. This detector employs two three inch focal length optical systems and detects the effect of field filtering by means of a reticle in each. The detectors are Ektron cells. Development hardware of similar design, using reticles oriented angularly with respect to each other to detect drift angle, has been delivered but apparently was not notably successful, judging from the comments of the [redacted] people. 25X1A 25X1A

Some parts of equipment using the SOLO principle were displayed. The scanner operates at 60 cps, and is driven by a Globe three-phase 400 cps induction motor, approximately size 11 frame.

Two demonstration films were screened, both of which showed an experimental SOLO scanner locking on to and tracking ground targets, from a moving vehicle on the ground, and from a small aircraft. In these films the camera platform was slaved to the scanner and tracking occurred after the operator manually selected an appropriate target. Target acquisition occurred promptly, apparently in a fraction of a second. The point tracked appeared to be one of contrast and target areas both lighter and darker than the surround were tracked. A vertical aerial view from an altitude of 9000 feet showed similar performance when the scanner was simply manually re-set at a forward angle and allowed to lock-on to any target, and then to track this target. A portion of the film which purported to show that the device would track the ground in the presence of cloud cover was inconclusive, in the view of this observer, since tracking appeared to occur on the cloud fine structure. A scene in which tracking occurred on surface detail of a large water area showed some hunting.

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RAG/MDG [redacted]